THE JOURNAL OF THE
CANADIAN ASSOCIATION OF RADIOLOGISTS

Volume IV December 1953 Number 4

PULMONARY HISTOPLASMOSIS
A PROBLEM FOR THE ARMED SERVICES AND CIVIL DEPARTMENTS OF HEALTH

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This is written following experience with survey chest films of service people during the late World War and the Korean War, and also with surveys of university students and nurses. Included also are hospital admission films of chests and diagnostic chest films of hospital patients and out-patients. These experiences pose a problem. The problem is Pulmonary Histoplasmosis.

In a broad way, Pulmonary Histoplasmosis may be looked upon as a nuisance disease. It is true that it does assume, rarely, a deadly form. However, the guise in which it usually presents itself is benign. Most often it is quite innocent of symptoms. That is when it becomes a nuisance.

However, in its acute form it is readily confused with active pulmonary tuberculosis or one of the pneumonias. In its more chronic stages it may still be confused with possible active tuberculosis. Its nodular form when single has been confused with bronchogenic carcinoma and when multiple, with secondary carcinoma.

Most people affected by this disease are unaware of its presence and only become aware of it after an X-ray survey of the chest for possible tuberculosis. Its discovery comes as a surprise.

The subsequent diagnostic procedures are sometimes not handled well. In some instances, the sanatorium engulfs the patient before the true significance of the disease is recognized, and in the presence of a negative tuberculin test. Patients entering sanatoria, with what is later diagnosed as histoplasmosis,can contract, and sometimes do contract tuberculosis during investigation and treatment.

Candidates for enlistment in the services may be rejected unnecessarily because of this disease.

For these reasons it seems worthwhile to try to correlate certain thoughts and findings which have accumulated in the last few years. One hopes, as part of the solution of the problem, by means of skiagrams, to demonstrate a practical picture gallery of histoplasmotic events within the thorax. It is of interest to note that X-ray films of the abdomen may show calcified glands, the result of histoplasmosis affecting the mesenteric lymph nodes.

It is important that clinicians and radiologists dealing with survey films of chests of recruits and other surveys should have a ready working knowledge of the common X-ray findings of the condition.

In spite of repetition, let us consider the following:

As is now well known, this disease may, *rarely*, manifest itself in virulent form and cause death. In these cases there is wide dissemination of the infection, involving the reticulo-endothelial system. It may occur in an acute form with pulmonary findings, fever, and illness of several weeks or months duration. *Commonly*, it is wide-spread throughout the lungs and shows itself only by disseminated calcification, picked up by routine X-ray examination of the chest. There are usually no subjective symptoms in this latter form.

There follows herewith a number of reproductions of skiagrams showing different ways in which this disease shows itself radiologically. Short explanatory notes are given. The figures are grouped according to the type of the disease as manifested in skiagrams of the chest.

1. Virulent type.
2. Pneumonic type.
3. Disseminated type (the commonest in our area — we think).
4. Nodular type.
5. Solitary nodule type.

Virulent Type

Figure 1

(Courtesy of Dr. Desmond Burke)

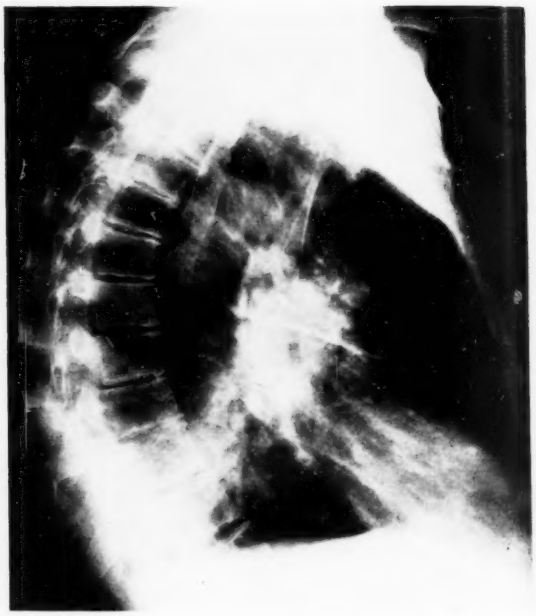

Figure 2

(Courtesy of Dr. Desmond Burke)

Male, age 69 yrs.

History of sleeping with his dog for eight years.

Admitted to hospital unkempt, emaciated, confused and very ill. Had been known to be depressed and ill with loss of appetite for two months. Had lost twenty or thirty pounds in weight. Marked oedema of legs. Died three days after admission.

X-ray films show pneumonia and oedema in lower halves of both lungs, along with hilar lymph gland enlargement and calcification.

One small calcified node is seen in the lung fields at level of fourth interspace in front on the left side. This node is not distinctive. Any other possible evidence of scatter calcified foci in the lung fields is obscured by overlying shadows of pneumonia and oedema.

Autopsy — The pathologist reported extensive patchy pulmonary consolidation with enlargement and calcification of the hilar lymph nodes. The microscopic examination showed chronic and active infection of the lungs and lymph nodes with the Histoplasma Capsulatum. The lungs were said to show both old and new lesions.

Dissemination of the infection throughout the recticulo-endothelial system was present with granulomatous lesions of the liver, spleen and kidneys.

This fulminating type of case would not likely be diagnosed ante-mortem unless definite search was made for the specific organism, and it could be demonstrated in a smear or culture of the sputum, or from a punch biopsy, or isolated from or demonstrated in the blood. The histoplasmin skin test and complement fixation test would be helpful.

Fortunately, this aspect of the disease is rare.

Pneumonic Type

Fig. 3 ⟶ *(Courtesy of Dr. Clarke White)*

Male, age 8 yrs.

Films made Jan. 1944, approximately two months following an acute respiratory illness with pyrexia, cough and expectoration. Note pneumonic consolidation in upper right paravertebral field. Also circular opacity, second anterior right interspace. Symptoms subsided after a couple of months.

Repeated tuberculin tests were negative.

In Aug. 1946 histoplasmin test positive, and has remained so.

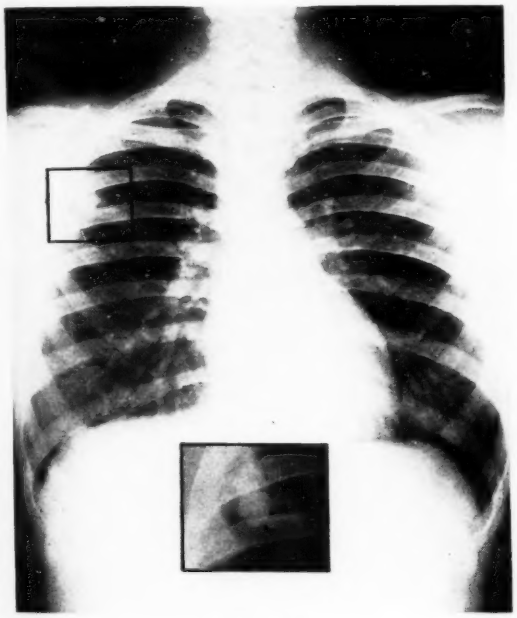

Figure 4

Fig. 5 ⟶ *(Courtesy of Dr. Clarke White)*

Same case as figure 3.

Two and one half years still later. The spiral calcified node has now become homogeneously dense.

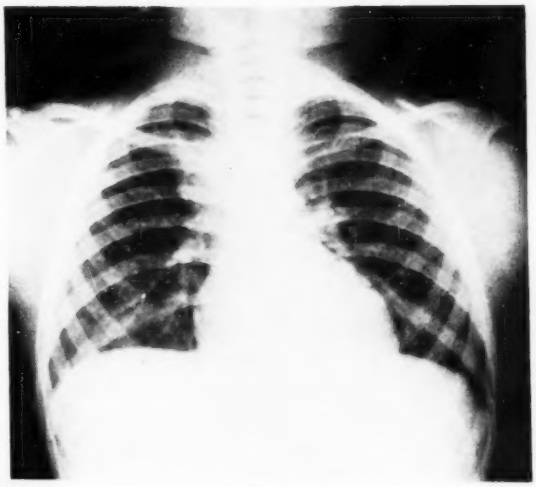

Figure 3

⟵ Fig. 4 *(Courtesy of Dr. Clarke White)*

Same case as figure 3.

A little more than five years later. Note calcified nucleus with a spiral of calcium surrounding it in the same region as the circular opacity seen in figure 1. Also calcification at right hilus.

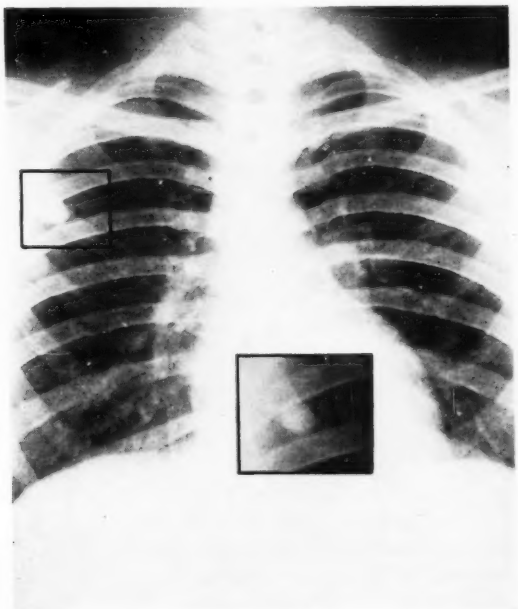

Figure 5

Pneumonic Type

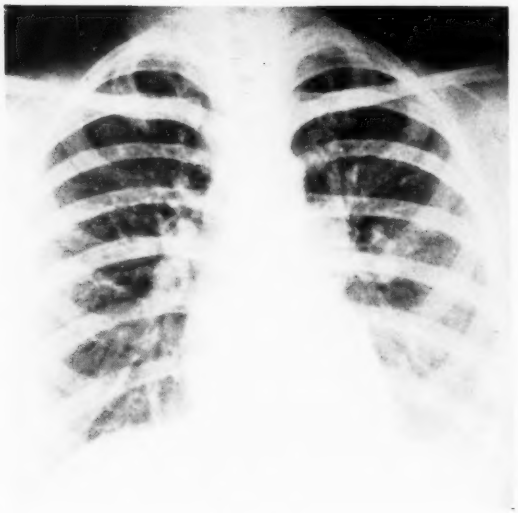

Figure 6

(Courtesy of Dr. Clarke White)

Female, age 21 years.

Films made October 1930.

Onset insidious over a period of four months with fatigue, lassitude, and bilateral chest pain. No cough or expectoration. In sanitorium for seventeen months. Kept on limited activity for eight years. Film showed shadows suggesting virus-pneumonia-like involvement of upper parts of both lungs. No tubercle bacilli found.

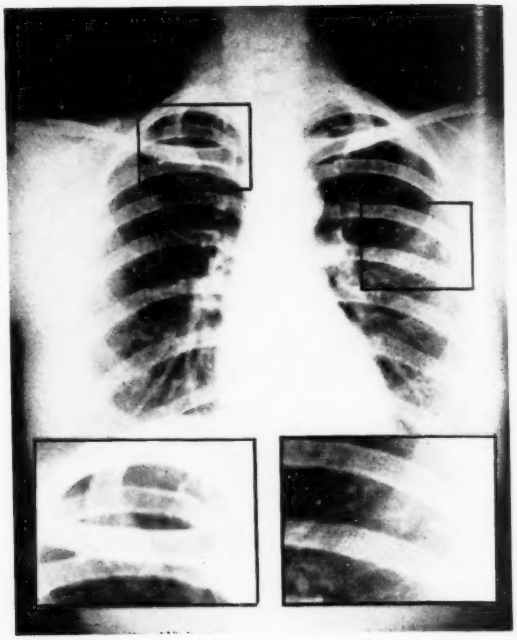

Figure 7

(Courtesy of Dr. Clarke White)

Same case as figure 6.

Film made nearly twenty years later.

Note scattered calcification (without a halo) in both apices, right first interspace and left upper three interspaces.

Tuberculin negative.

Histoplasmin positive.

Disseminated Type

The two figures which follow show what might be argued to be a broncho-pneumonic type rather than a disseminated type of this disease. It is possible that all disseminated types may be broncho-pneumonic in their acute and subacute phase. The number of small calcifications seen in films may be very few or may be innumerable. Films may show disseminated soft shadows, without calcification, with enlarged hilar glands, posing a differential diagnosis of secondary carcinoma, sarcoidosis or histoplasmosis.

Disseminated Type

Figure 8

Fig. 9 ⟶ *(Courtesy of Dr. Clarke White)*

Same patient eleven years later.

The film shows very extensive disseminated calcified nodules. In the film itself a few nodules show haloes of much softer density than the calcified centre. Other nodules show nebulous edges. Man well except for gradually increasing dyspnea.

Tuberculin test, 1949, positive.

Histoplasmin test, same time, positive.

Dr. White has also shown me early films of a disseminated type in another case. The first films showed tenuous shadows that might be labelled "bronchiolitis" or simply "increased markings" — "question hazy mottling". In about four months the films were clear. In about three years typical small calcified nodes of the disseminated type were present.

Tuberculin — negative.

Histoplasmin — positive.

⟵ Fig. 8 *(Courtesy of Dr. Clarke White)*

Male, age 53 years.

A film made of one of a group of 23 men who suffered "acute miliary pneumonitis" in one of the historical epidemics of this disease at Plattsburg N.Y., Nov. 1938. The epidemic followed exposure to dense dust during the tearing down of a school belfry which was the depository of four feet depth of pigeon droppings, pigeon nests and dead pigeons.

One week after exposure to the dust he became suddenly ill with pyrexia. Cough and expectoration developed a few days later. He remained in bed six weeks and was off work about eight weeks.

No tubercle bacilli found.

The film presents the appearance of extensive broncho-pneumonia.

Figure 9

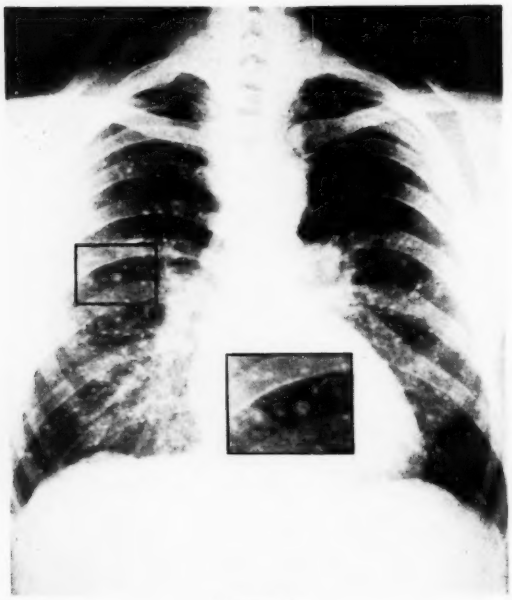

Figure 10

Fig. 11 ⟶

Soldier, male, age years.

Symptom free. No respiratory history.

Worked with a poultry farmer for four months.

Films show numerous small calcified nodules. Some nodules have nebulous haloes. Some look like nodes in a web of irregular fine markings.

Tuberculin negative.

Histoplasmin positive.

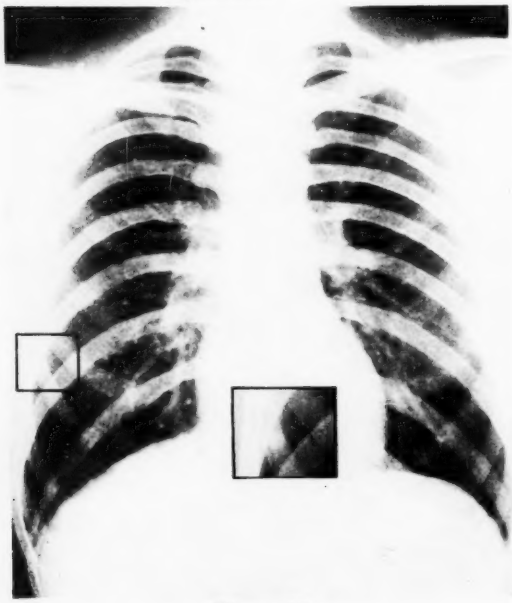

Figure 12

⟵ Fig. 10

Male, age 41 years.

Now an industrial worker. Formerly worked on a farm.

Symptom free. No respiratory history.

Widespread disseminated nodules. Nearly all nodules show haloes plainly in film. The haloes are not so well seen in the reproduction.

Tuberculin negative.

Histoplasmin positive.

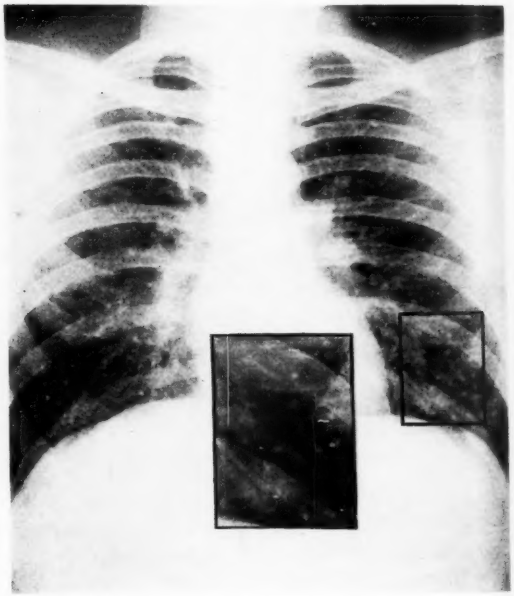

Figure 11

⟵ Fig. 12

Farmer, male, age 25 years.

Patient sent for X-ray of chest for possible evidence of Pulmonary Tuberculosis. This followed a laparotomy, at which time a calcified mesenteric lymph gland was noted.

No respiratory symptoms or history.

Film, characteristic of histoplasmosis with a few scattered nodules and a definite haloed calcification overshadowed by right sixth rib at lateral wall of chest. Not shown as definitely in the reproduction.

Tuberculin negative.

Histoplasmin positive.

Disseminated Type

Fig. 13 ⟶

Nurse, female, age 18 years.

Typical disseminated calcifications. Patient symptom free. For past five years this calcification has been commented upon during chest surveys.

Tuberculin negative.

Histoplasmin positive.

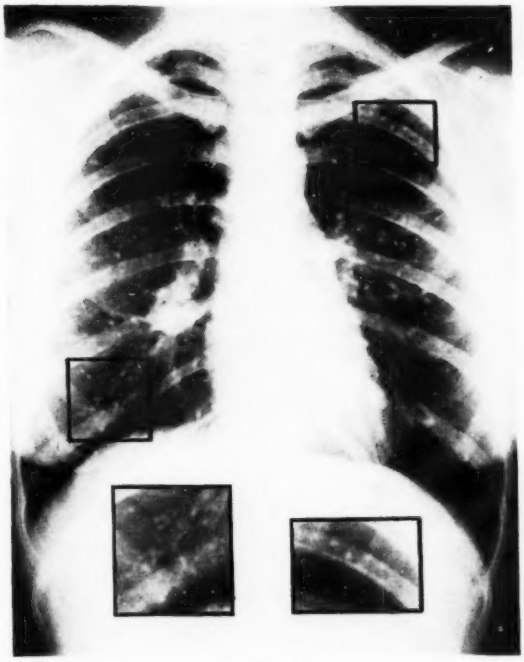

Figure 13

Nodular Type

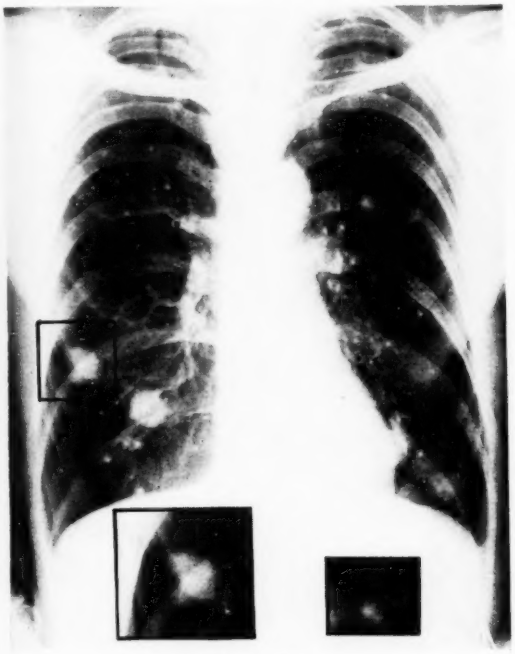

Figure 14

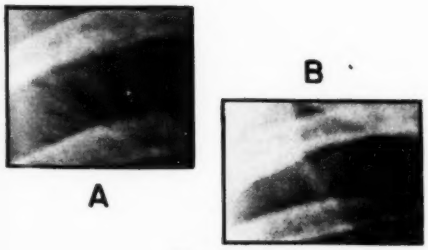

Figure 15

← Fig. 14

Male, age 43 years.

Small and large nodes with calcified nuclei and large haloes. Some measure 2.5 cms. in diameter.

Patient symptom free.

Nodules known to have been present for five years.

Had formerly been diagnosed as secondary carcinoma.

The nucleus plus the halo, however, is characteristic of histoplasmosis.

Tuberculin negative.

Histoplasmin positive.

Solitary Nodule Type

← Fig. 15A & B

Two examples of solitary nodes. Patients symptom free. These likely contain calcium, but do not have haloes.

Tuberculin negative.

Histoplasmin positive.

Solitary Nodule Type

Fig. 16 ⟶

Male 53 years.

Respiratory symptoms negligible. Patient had a chronic cough, something that might be looked upon today as almost physiologically pathological in the cigarette smoker.

Lesion discovered in a routine film for chest examination. A solitary focus in left base with a calcified centre and a halo. Removed surgically. The section stained for fungus showed a granuloma with histoplasmotic characteristics. The organism Histoplasma Capsulatum was found in large numbers.

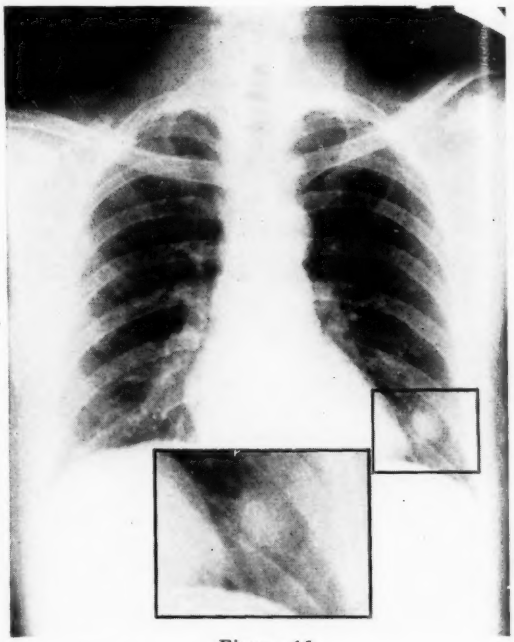

Figure 16

⟵ Fig. 17

Male, 36 years.

No respiratory symptoms. Picked up on miniature film of chest. A solitary focus in right base with a calcified centre and halo. The skin reacted strongly to histoplasmin, but was negative to tuberculin.

Section of the removed focus showed a granuloma consistent with histoplasmosis, and the organism was found.

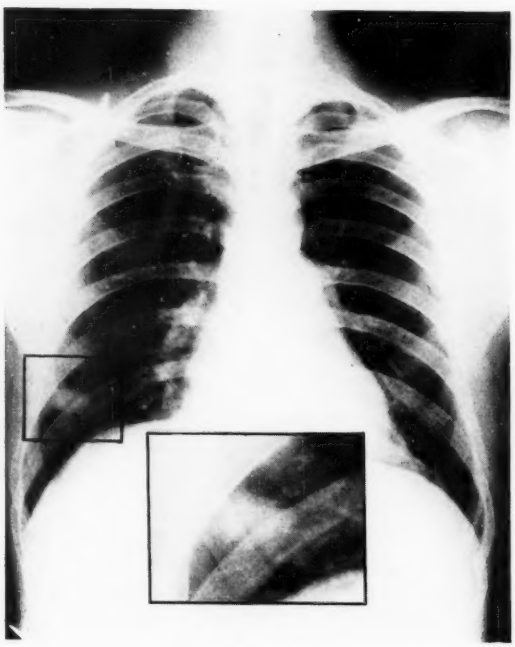

Figure 17

Fig. 18 ⟶

Small solitary node with halo. Calcification in centre. Calcification at right hilus. The two connected by a linear marking similar to a calcified primary tuberculous complex.

No respiratory symptoms or history.

Tuberculin negative.

Histoplasmin positive.

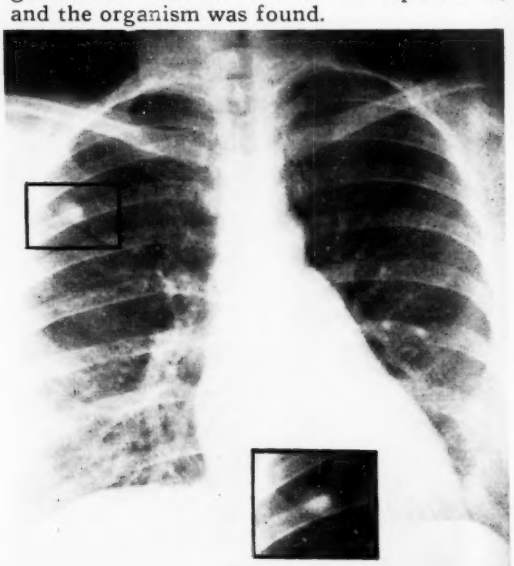

Figure 18

Solitary Nodule Type

Fig. 19 —>

L. C. Male, age 30 years — Former Soldier.

Film in 1940 on enlistment in Army clear and negative. This reproduction is of a film made in 1942 in England.

Clinical diagnosis of pneumonia.

There is a general increase in pulmonary markings particularly around hilar regions. There is also a round opaque density at the level of the first interspace in front on the right side.

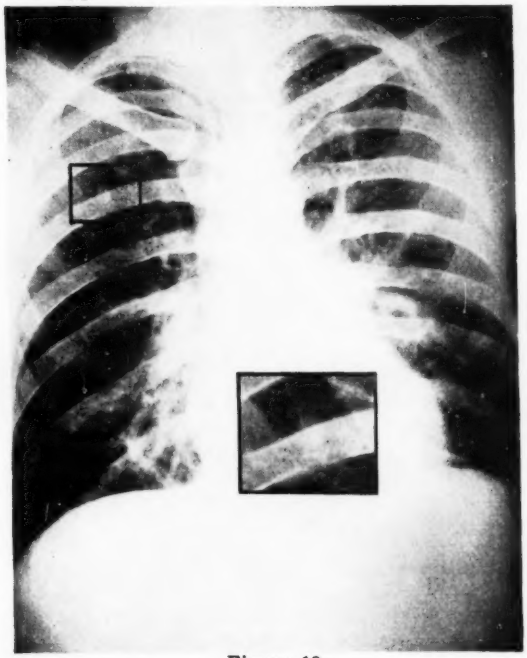

Figure 19

<— Fig. 20

Same patient as Figure 19.

This film made 1945.

Opaque area again seen. It is larger.

It has a definite calcified nucleus with a halo.

Patient has no respiratory symptoms.

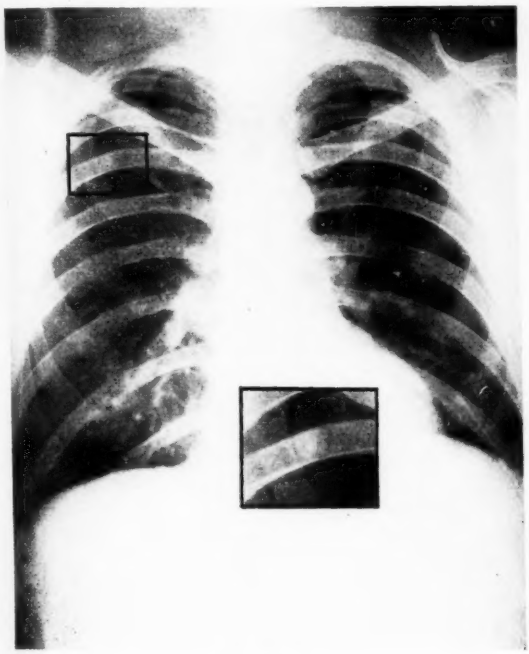

Figure 20

Fig. 21 -->

Same patient as figures 19 and 20.

This film made 1952.

The opaque node has grown considerably.

Patient has no respiratory symptoms.

Tuberculin question.

Histoplasmin positive.

(Dr. Clarke White has shown me films demonstrating similar growth changes in a number of nodules in one patient.)

This case is under observation. The problem is whether or not the lesion will continue to grow or become static. Will it break down?

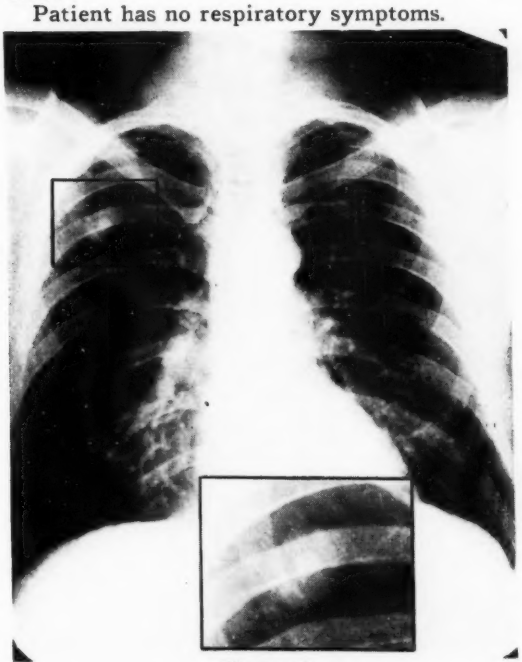

Figure 21

Discussion

The differential diagnosis between histoplasmosis and other pneumonic lesions may be difficult. In the acute phase the organism Histoplasma Capsulatum may be found in the sputum by smear or culture. The complement fixation test is also of value in the acute stage. Skin tests should be made in all chest lesions. In that way there may be found early evidence of the disease. The pneumonic type may be found then more commonly. A negative tuberculin and a positive histoplasmin skin reaction give a good lead, always remembering that even though the skin is histoplasmin positive, this does not mean that the X-ray findings are necessarily indicative of histoplasmosis. In our area about 20 to 30 percent of all university students tested are histoplasmin positive. This is not a fair cross-section as many of our students come from far afield. We do not as yet have figures for the general population here.

It has been said that the histoplasmin skin test is not specific. Our experience has been somewhat different. In our area (Upper St. Lawrence River Valley and Bay of Quinte area) we commonly find the disseminated type, and occasionally the nodular type. In nearly every case with dissemination, or of the nodular type with calcified centres and haloes, we have been able to predict accurately a positive histoplasmin test. So that at least in our area, for the types mentioned, the test can be used with confidence.

Some cases of tuberculosis show calcification with a halo. However, it is the opinion of the author that the presence of either a nebulous or clear-cut halo around a calcified nodule or around one or more of a group of nodules is a definite invitation to consider the condition as Histoplasmosis until proven otherwise. It is amazing how specifically the skin test confirms this.

The difficult cases are the pneumonic ones and the nodules without haloes.

We believe that a study of the above reproductions and the accompanying notes will be helpful to those who are not familiar with this disease in their own locality.

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Acknowledgments:

I wish to thank Dr. Clarke White, Dr. Desmond Burke, Dr. W. D. Hay, Dr. G. F. Kipke, Dr. J. H. Orr, and the Staff of the Department of Radiology of the Kingston General Hospital, without whose help this paper could not have been prepared. Especially do I wish to thank Mr. Phillip Mott, for his kindness in preparing the reproductions, and the Audio-visual Committee of Queen's University.

THE RADIOLOGICAL DIAGNOSIS OF OBSTRUCTIVE EMPHYSEMA DUE TO NON-OPAQUE FOREIGN BODIES

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Much has been written about obstructive emphysema due to non-opaque foreign bodies. In reviewing the literature over the past thirty years, nothing new in the way of diagnostic aids has been added. However, existing aids have been greatly improved i.e. X-ray machines and bronchoscopic instruments

It is not the purpose of this paper to review the signs and symptoms of obstructive emphysema. Rather, it is to re-emphasize the importance of considering the diagnosis of foreign body aspiration.

In the past four years we have seen fifteen cases of obstructive emphysema due to non-opaque foreign bodies. The commonest offender, as in other series, has been of a vegetable nature, usually a peanut. This is probably due to the widespread sale of nuts and confections containing nuts. Other foreign bodies, which have been encountered, are a kernel of corn, a sunflower seed and in one instance chewing gum. The commonest age at which aspiration occurs, is usually between two and four.

Generally speaking the diagnosis of a foreign body aspiration is made soon after the accident. The parent realizes that a foreign body has been inhaled and brings the child at once to the physician. In other instances the reaction, in the case of vegetable foreign bodies, is so severe that the patient is brought immediately to the doctor. These severe reactions are of very grave import. It should be stressed however, that severe acute reactions, so frequently described in the literature are not common.

The sequence of events in cases in which the diagnosis of foreign body aspiration is missed, is as follows:

The child after aspirating a foreign body may cough or choke then settle down and the episode is forgotten. Several days later a persistent cough and possibly some fever develop. Finally after a week or ten days, or even as long as a month, the patient is brought to the physician. By this time the choking spell is forgotten, or the parents may not mention it, because of a feeling of shame at having left the child so long without medical attention. If the possibility of foreign body aspiration is NOT considered by the clinician, he will usually make the diagnosis of pneumonitis or bronchitis.

It is in these cases, if the patient is sent for a chest film, that the radiologist can make the diagnosis. A knowledge of the patient's symptoms, when interpreting films, is of the utmost importance. This cannot be over-emphasized.

All children with unexplained respiratory symptoms, should first be fluoroscoped. Inspiration and expiration films should then be taken, along with a single lateral. The possibility of a foreign body inhalation at the time symptoms started, should also be considered when the history is taken.

The following case brings out some of the above points. A child was sent for an X-ray examination of the chest with the tentative diagnosis of pneumonia. The initial chest film was suggestive of obstructive emphysema on the right side. Fluoroscopy with inspiration and expiration films readily confirmed the presence of obstructive emphysema. Further history elicited the story of a coughing spell, while the child was eating peanuts about a month previously. At bronchoscopy a portion of a peanut was removed from the right main lower lobe bronchus.

It is very important to realize that the diagnosis of obstructive emphysema can readily be missed in a routine film of the chest. Where the child is unco-operative, it is very difficult to get good films in inspiration and expiration and it is here that fluoroscopy plays an important part in the diagnosis. In one of the cases to be shown, it was not possible to be sure if obstructive emphysema was present from the films alone. However, fluoroscopy readily confirmed the clinical diagnosis of obstructive emphysema due to an aspirated foreign body.

Normal radiological findings do not exclude the presence of a foreign body. In such cases where a foreign body is strongly sus-

pected clinically, the patient should be bronchoscoped.

One of the commonest forms of bronchial obstruction is of the ball valve type. As this gives definite radiological signs, the diagnosis can usually be made by following the above procedure.

Typical example of Obstructive Emphysema

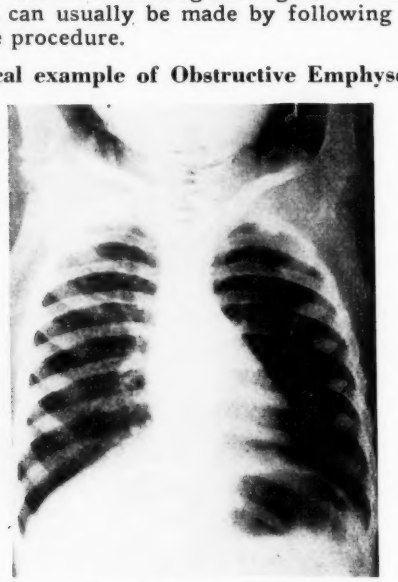

Figure 1A.—Inspiration

Case 1.

B.E. — male — two and a half years of age was eating a nut bar while his mother was cutting his finger nails. He began to cry and choked and the mother noted that the breathing was noisy and wheezy. A physician was called three hours later and the possibility of an aspirated foreign body was considered. The child was taken to hospital and X-ray examination showed typical changes of obstructive emphysema on the left side of the chest. Bronchoscopy was done and half a section of peanut was removed from the left main bronchus.

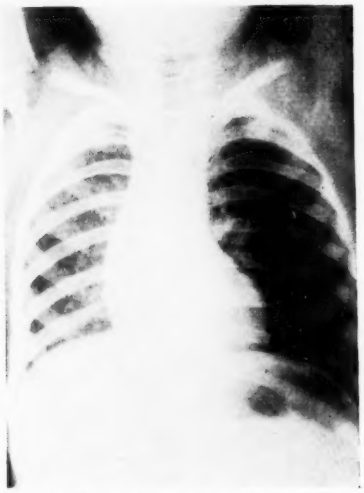

Figure 1B.—Expiration

Figure 1. shows on inspiration some suggestion of increased transparency on left. On expiration mediastinum shifted to right — marked transparency of left lung — little change in level of left diaphragm between inspiration and expiration.

Case 2.

R. W. — Male — nineteen months of age. While chewing on a cob of corn he began to

Not diagnostic of obstructive emphysema

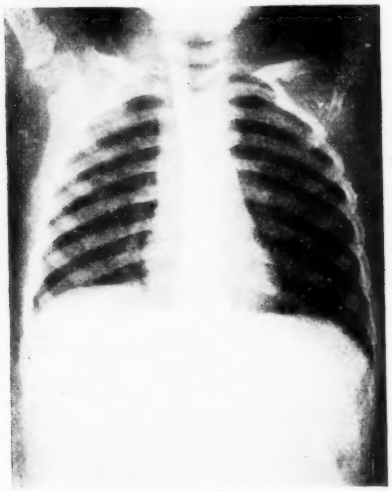

Figure 2A.—Inspiration

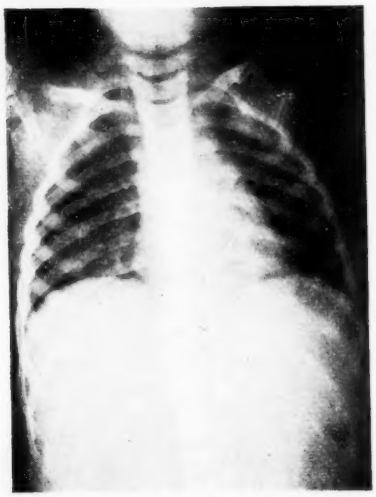

Figure 2B.—Expiration

gag and choke and then vomited. After coughing for about an hour the child developed a wheeze. A physician was called on the same day. X-ray films in inspiration and expiration were not diagnostic but fluoroscopy confirmed the presence of obstructive emphysema in the right chest. At bronchoscopy a kernel of corn was removed from the right main lower lobe bronchus.

Figure 2. This figure shows films in inspiration and expiration and no significant abnormality is seen.

Case 3.

H. K. — male — two years of age. While eating peanuts the child began to choke. This was followed by marked coughing and wheezing. X-ray showed signs of obstructive emphysema in region of the left lower lobe; marked interstitial emphysema was also present. At bronchoscopy a portion of a peanut was removed from the left main lower lobe bronchus.

Figure 3. This figure shows one of the complications of obstructive emphysema. The marked mediastinal shift in the expiration film along with the interstitial emphysema should be noted. In a case such as this if only a single P. A. film had been taken in quiet respiration one might have fallen into the trap of diagnosing atelectasis on the right side. The importance of knowing the history in a case like this is obvious.

Marked shift to normal side on expiration film and also interstitial emphysema

Figure 3A.—Inspiration

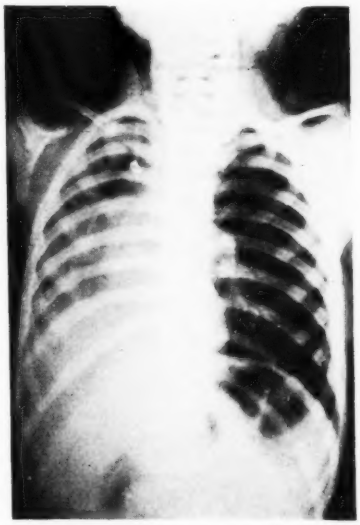

Figure 3B.—Expiration

Case 4.

R. R. — male — three years old. While eating a nut bar chocked and then developed a cough. Could not be bronchoscoped in the country and was brought into the city six days later. Only a single P. A. X-ray was taken at the time. This showed some increased transparency of the left lung field as compared with the right. At bronchoscopy part of a peanut was removed from the left main bronchus.

Figure 4. This case shows that the possibility of foreign body aspiration should be considered when only a routine film has been taken.

Figure 4A.—Routine P. A. Chest film in inspiration showing slight decreased density left lung field.

Although this is not diagnostic, the changes are sufficient to make one suspicious enough to carry out further examination.

Figure 4B.—P. A. chest film in inspiration after removal of foreign body from left main bronchus.

Summary:

1. Fluoroscopy is of the utmost importance in making a diagnosis, as it is sometimes very difficult to get good inspiration and expiration films. With a history of possible foreign body aspiration, the radiologist should fluoroscope the patient first, then follow with inspiration and expiration films and a single lateral.

2. When a foreign body is not suspected, X-ray taken in full inspiration may show slight change in transparency of lung fields. In these cases, if in doubt, fluoroscope and take inspiration and expiration films. It must be realized that radiologically the diagnosis of foreign body aspiration can easily be missed when only a single P. A. film in inspiration is taken.

3. The possibility of a foreign body aspiration should be considered in the child with an unexplained cough, fever, and wheeze.

4. The violent reactions produced by vegetable foreign bodies are not common.

5. With only a single P. A. film in quiet respiration marked mediastinal shift due to obstructive emphysema may lead one to a diagnosis of atelectasis on opposite side of chest. The history is very important here in making a correct interpretation.

6. If fluoroscopy and films are negative, and clinically there is strong suspicion of foreign body aspiration, bronchoscopy should be done.

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ISODOSE CURVES FOR INTRA-CAVITY ROENTGEN THERAPY

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Isodose curves for the small fields used in intra-cavity therapy have not been available due to the lack of ionization chambers of sufficiently small volume to permit a series of readings across a small field. Such depth dose data as is available has usually been center-line values taken for fields 5 cm. in diameter.

In the past three years ionization chambers of small volume have become available. The one used for this work was described by Turner and Newbery. Their design has been modified to make use of a single electrometer tube in the probe. The output of the pre-amplifier in the probe was fed into a d-c amplifier. The probe was made waterproof by enclosing it in a thin rubber container. A Selsyn motor arrangement was used to move the probe in a lucite tank filled with water. This measuring arrangement was checked with a Victoreen r-meter that had been calibrated against a standard air chamber.

Isodose curves were plotted for the technic most used in this type of work — 140 kvp — 0.25 mm. copper filter — half-value layer 0.5 mm. copper.

Data were taken for two types of intra-cavity specula. One was the conventional periscope with metal tube specula and the other was the type which uses a bakelite speculum fitting into a heavy metal diaphragm.

The periscope was equipped with cones 2, 2.5, 3, 3.5, 4 and 5 cm. in diameter. The distance from the focal spot to the tip of the cones or specula was 40 cm.

The bakelite speculum used was 3.8 cm. in diameter. The commercial product of this type is provided with three specula providing diameters of 3.6, 3.8 and 4.0 cm. Due to the small variation in diameters data were taken with the 3.8 cm. speculum only. The speculum used gave a focal-spot to cone-tip distance of 26.5 cm.

The reason for the use of a bakelite speculum is that it gives a larger field than a

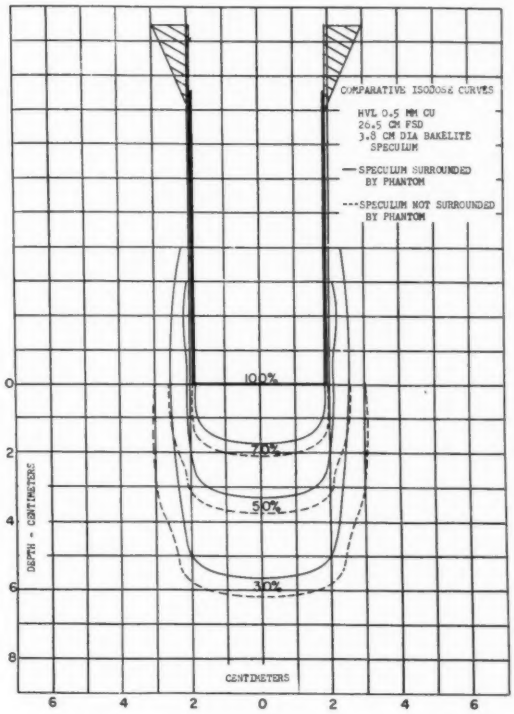

Fig. 1 — Comparative Isodose Curves for Bakelite Speculum above and Immersed in Phantom.

metal speculum since the walls are more transparent to radiation permitting radiation to spread through the walls of the speculum. This is of advantage in patients unable to tolerate a metal speculum large enough to provide a comparable field. Such studies of the field provided and studies of the center-line depth dose as found in the literature indicated that the cone tip had been placed at the top of a phantom. Depth doses had then been taken in the phantom or the field size arrived at by placing films on the surface or in the phantom. This arrangement should be valid for specula having heavy metal walls which define the field within the diameter of the metal walls. Such a set-up is not valid for the bakelite specula, however, since the speculum, when inserted into the vagina, is

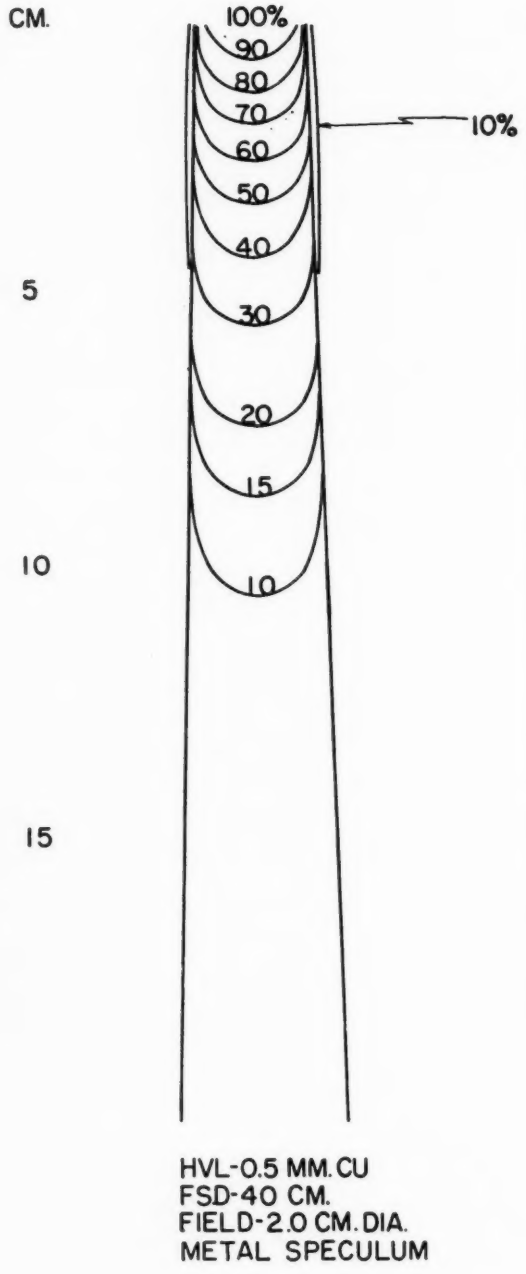

Fig. 2 — Isodose Curves for Periscope with Metal Cones 2, 2.5, 3, 3.5, 4 and 5 Cm Diameters.

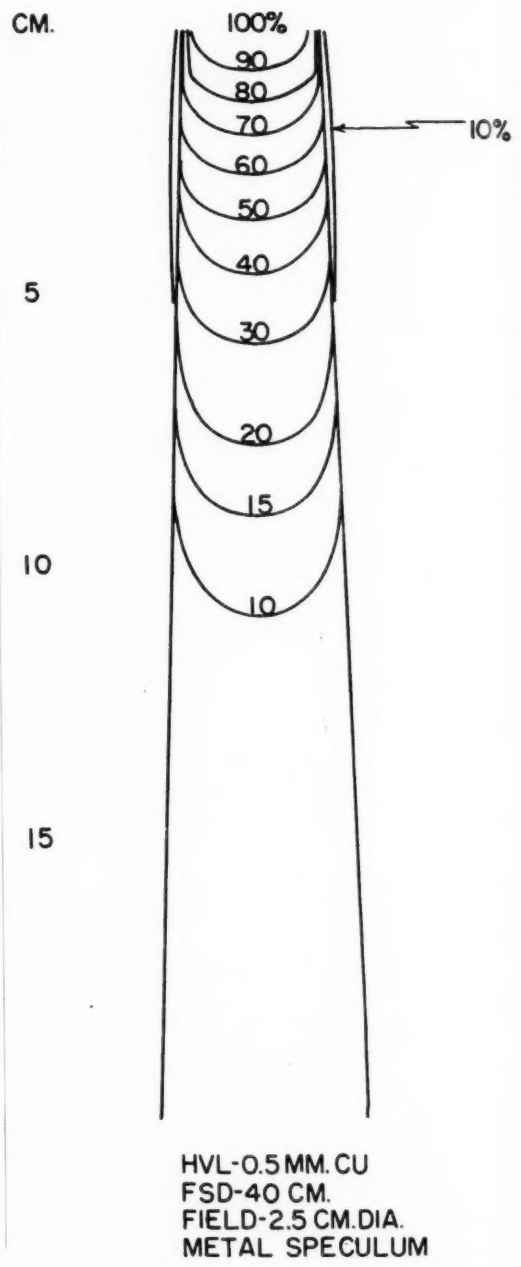

Fig. 3 — Isodose Curves for Periscope with Metal Cones 2, 2.5, 3, 3.5, 4 and 5 Cm Diameters.

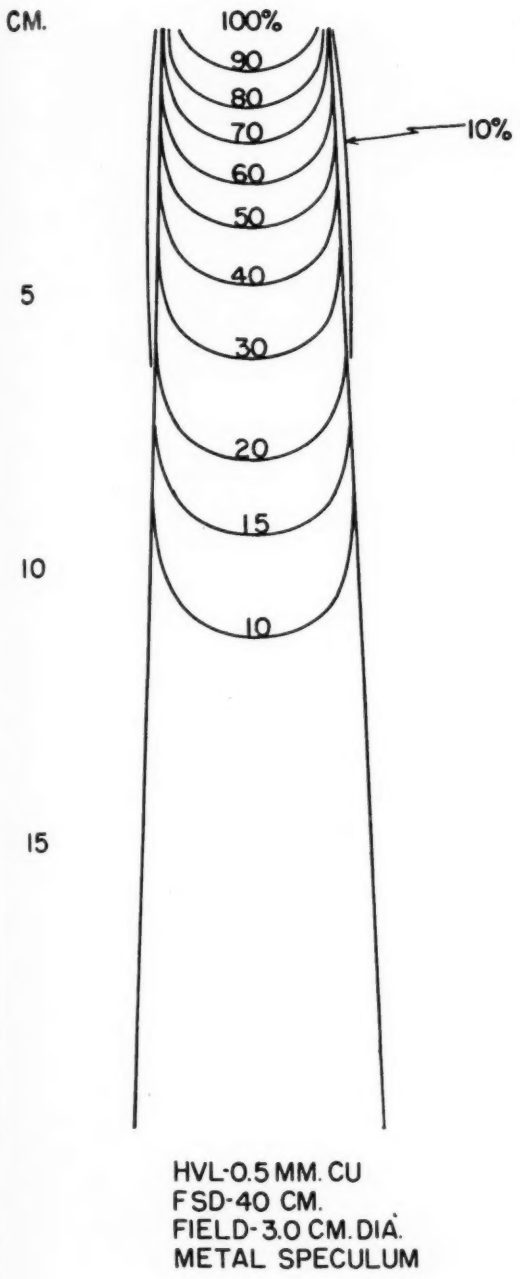

Fig. 4 — Isodose Curves for Periscope with Metal Cones 2, 2.5, 3, 3.5, 4 and 5 Cm Diameters.

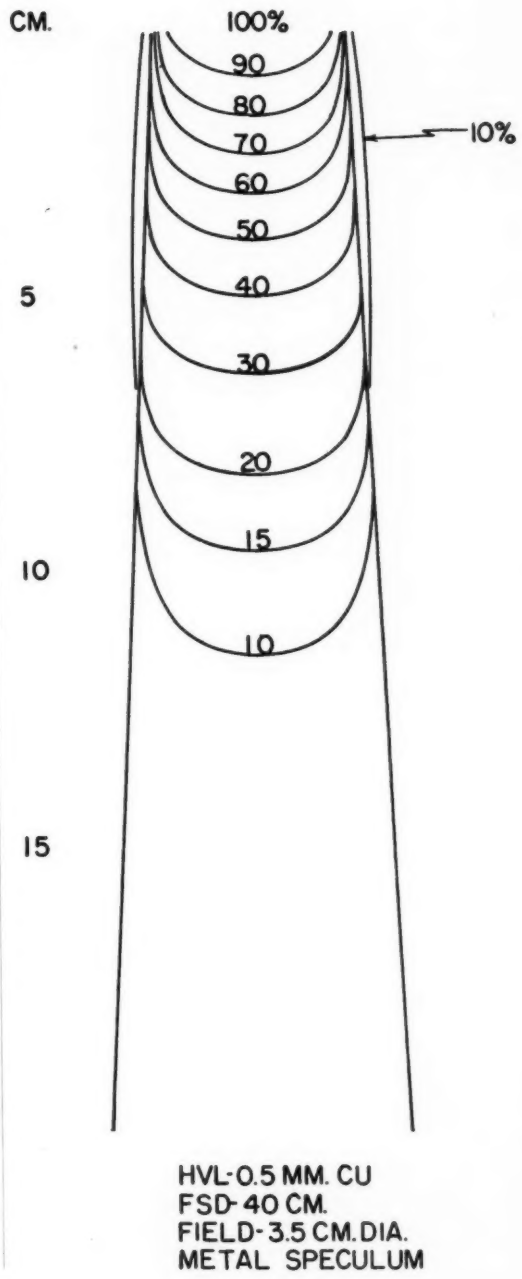

Fig. 5 — Isodose Curves for Periscope with Metal Cones 2, 2.5, 3, 3.5, 4 and 5 Cm Diameters.

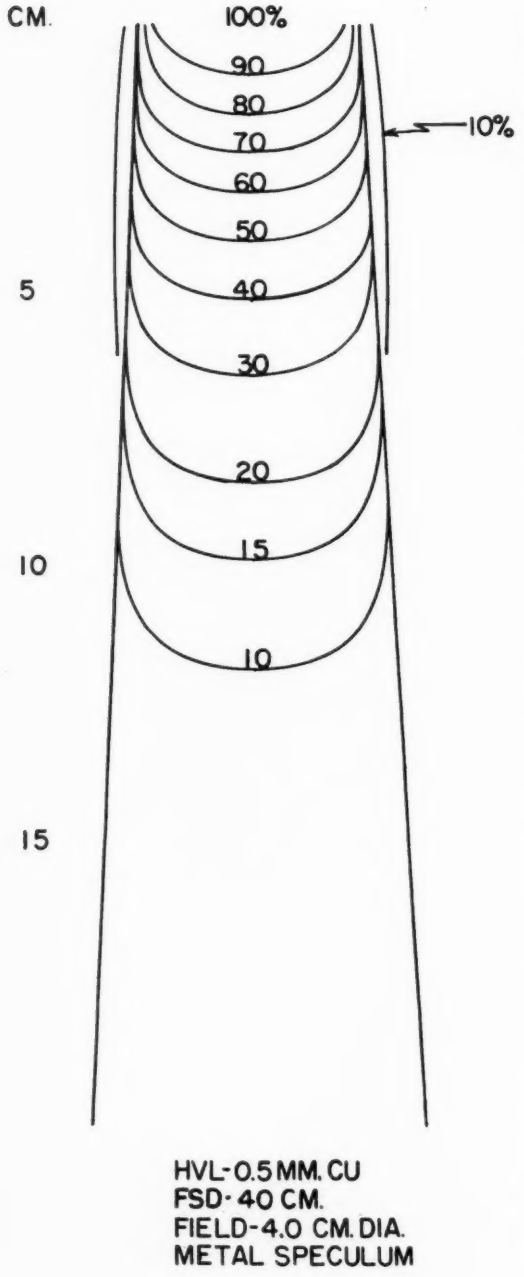

Fig. 6 — Isodose Curves for Periscope with Metal Cones 2, 2.5, 3, 3.5, 4 and 5 Cm Diameters.

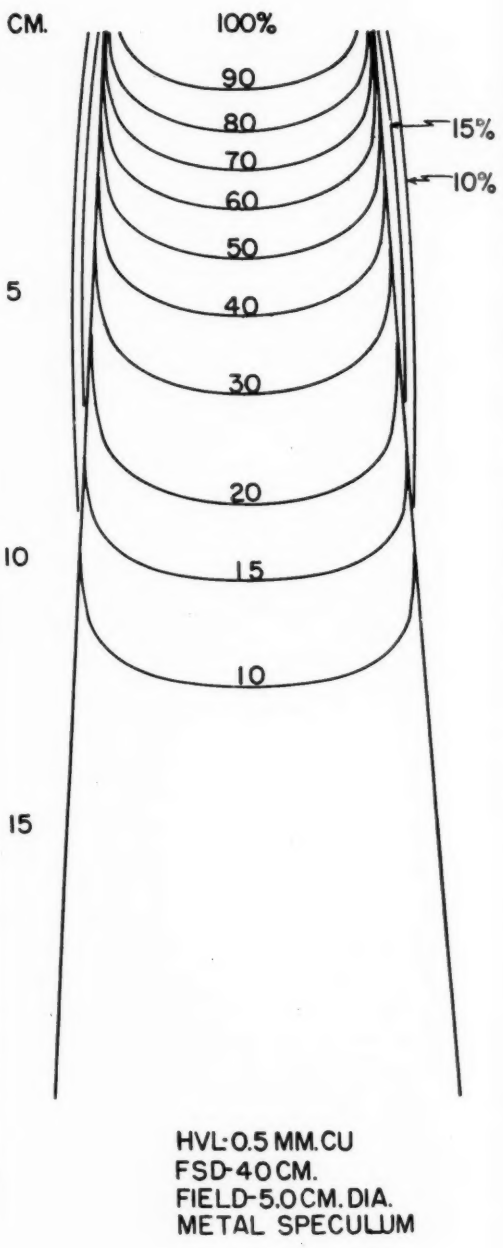

Fig. 7 — Isodose Curves for Periscope with Metal Cones 2, 2.5, 3, 3.5, 4 and 5 Cm Diameters.

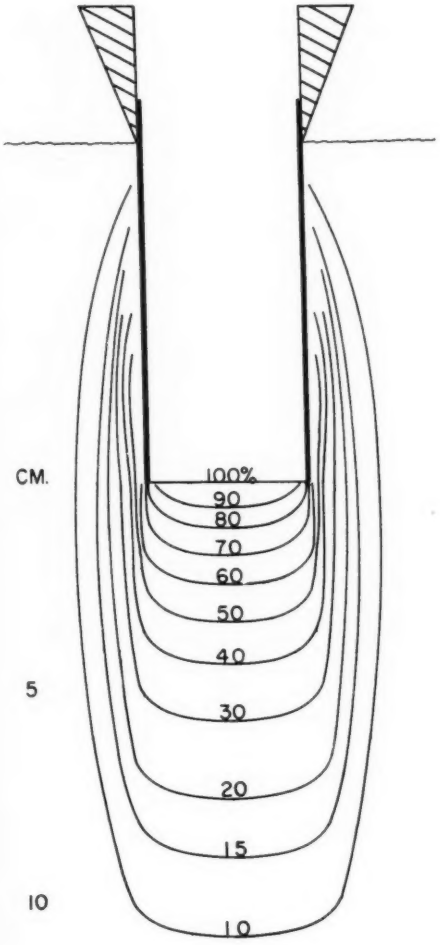

Fig. 8 — Isodose Curves for Bakelite Speculum 3.8 Cm in Diameter.

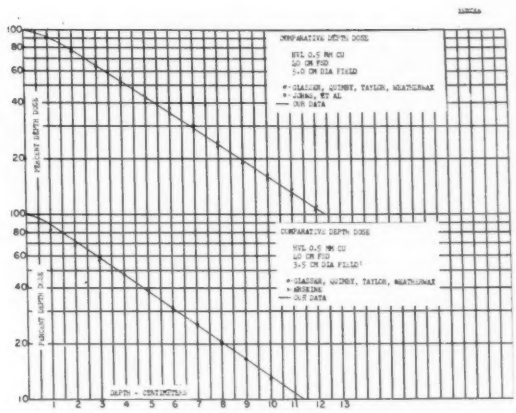

Fig. 9

Comparison of Center-line Data

surrounded by tissue. The tissue acts as an added cone or speculum wall. It was felt that to reproduce the conditions of actual practice the specula should be immersed in the phantom to a depth comparable with use. A thin rubber membrane was placed over the end of the speculum to prevent water from entering the speculum which would not be filled with tissue when inserted into a cavity.

Reference to Fig. 1 will indicate the comparative results obtained with the bakelite speculum at the surface and inserted into the phantom. As is to be expected the field irradiated is smaller when the speculum is immersed.

Tests made with the metal cones or specula show no significant differences in field or isodose patterns whether immersed or above the phantom.

Isodose curves for the metal specula are shown in Figs. 2-7. Similar data for the bakelite speculum is shown in Fig. 8.

A comparison of the center-line values from this study and those of other investigators is shown in Fig. 9.

Since the dose at the end of the speculum is the skin or surface dose (100%), the air dose as measured by a chamber at the end of the speculum must be multiplied by the appropriate backscatter factor. The backscatter factors determined by experiment are shown in Table I.

TABLE I

Backscatter Data

Half-Value Layer 0.5 mm. Cu

Metal Specula

Area of field, cm^2	3.1	4.8	7.1	9.6	12.5	19.6
Diameter, cm	2.0	2.5	3.0	3.5	4.0	5.0
Air Dose	93	90	88	87	85	83
Backscatter Factor	1.08	1.11	1.13	1.15	1.17	1.21

Bakelite Speculum

Area of field, cm^2	11.3
Diameter, cm	3.8
Air Dose	80
Backscatter Factor	1.25

Work is continuing to complete this study for half-value layers up to 3 mm. Cu.

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In Memoriam

FERRIER, Herman John

May 17th, 1893, Hartney, Manitoba

M.D. — University of Manitoba 1920.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

Roentgen Diagnosis of the Heart and Great Vessels, by Erich Zdansky and translated by Linn J. Boyd. Grune & Stratton, Inc., Publisher. The Ryerson Press, Toronto.

Clipped Capital Femoral Epiphysis, by Armin Klein, Robert J. Joplin, John A. Reidy and Joseph Hanelin. Charles C. Thomas, Publisher. The Ryerson Press, Toronto.

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ERRATUM

In the September 1953 issue, page 63, figure 1 should have been transposed with figure 1 of second case which appeared on page 64.

RESULTS OF TREATMENT FOR CANCER OF THE LARYNX*

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and

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Laryngectomy offers a means for saving the lives of a considerable proportion of patients suffering from operable cancer of the larynx. Individuals submitted to this mutilating, disabling operation are, however, usually members of small and carefully selected groups — screened not only by the operating surgeons, but at an even earlier date by their family physicians. Seldom in the report of a surgically treated series, does one see mention of the number of patients deemed unfit for this formidable procedure, or of those who refuse a treatment plan which inevitably results in a permanent tracheotomy and permits, at best, of a makeshift voice for the ambitiously persistent minority who master the difficulties of oesophageal speech. Were the patients who are not operated upon included, a more accurate picture would be presented of the curability of this disease by surgery. A measure of the important position occupied by those, who for one reason or another, do not have their larynx removed, is afforded by realization that the annual incidence of cancer of the larynx in the United States — based upon the statistics from Connecticut[1] — exceeds the estimated number of laryngectomies performed[2] by five to one.

Successful treatment of cancer of the larynx puts a tax upon all the therapeutic facilities at our disposal. In no other commonly occurring variety of cancer are the results so entirely dependent upon the day by day clinical judgment of the attendant physician and his ability to co-ordinate the use of surgery and irradiation. The anatomical peculiarities of the larynx not only determine the nature of the various growths encountered and influence their progress, but also affect their response to treatment. Proximity to the important structures of the neck and interference with the respiratory act are frequent causes of failure, and create problems entirely different from those encountered in treating histologically similar tumours of such non-vital organs as the cervix uteri. This paper is based upon experience derived from the treatment of 67 patients. In our clinic 1.5 per cent of all cancer originated in the larynx. These people have presented more problems than were encountered in any other group of similar size. We have fallen into many pitfalls, and, on occasion, successfully extricated ourselves. There have been many failures, but improved results in late years indicate the value of the lessons to be learned.

The larynx is essentially a cartilaginous box, lined by stratified epithelium. The cartilage tends to block the outward spread of cancer arising from the lining of the box and so, fortunately, cancer of the intrinsic larynx tends to remain localized in the laryngeal structures for considerable periods of time and does not metastasize except by late extension. Unfortunately, however, cartilage here, as elsewhere, presents its own peculiar difficulties. Its poor blood supply predisposes to necrosis, from infection already present or that which may follow irradiation. If ultimately the cartilage does become involved by tumour cells, these can be eradicated only by surgical excision.

Cancers arising within the larynx proper and involving the true or false cords, the ventricles, the ventricular folds, the laryngeal surface of the arytenoids, and the immediate subglottic area, are commonly classified as cancer of the *intrinsic* larynx. Those which originate from the pyriform fossae, vallecular, ary-epiglottic folds, epiglottis, and posterior portions of the arytenoid region are cancers of the *extrinsic* larynx. The latter are usually undifferentiated, highly malignant, anaplastic tumours, sensitive to irradiation, but unfortunately prone to metastasize early. Treatment of cancer of the extrinsic larynx is by fractionated x-radiation. In the opinion of most authors, the primary tumour is completely unsuited to surgical procedures. Conservative surgical exposure with radon implantation has certain definite indications in the care of metastatic nodes which have not completely regressed under roentgen therapy.

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*Presented at the Sixteenth Mid-Winter Meeting of the Canadian Association of Radiologists, Toronto, January 30, 1953.

Case 1. Carcinoma of Extrinsic Larynx: A diabetic woman 56 years of age admitted on April 9, 1937, gave a three-month history of difficulty in both breathing and swallowing, with more recently an expectoration of blood. The epiglottis, right ary-epiglottic fold and both arytenoid regions were swollen and oedematous. The right arytenoid area was ulcerated, and a biopsy taken immediately lateral to the right ary-epiglottic fold contained anaplastic squamous cell carcinoma. Fractional doses of heavily filtered 200 kv X-ray therapy were applied through small fields six days a week over a period of 88 days for a total dose of 10,350 r, measured in air. Respiratory obstruction during the active treatment interval necessitated the performance of a tracheotomy on June 8th. Subsequent attempts to persuade the patient to forsake the tracheotomy cannula were unsuccessful — perhaps fortuitously, because of the development in June 1939 of a left sided hemiplegia, the result of a cerebro-vascular accident, from which she recovered. She ultimately died on Aug. 18, 1944, of myocardial disease.

Comment: This patient in an example of a case of cancer of the extrinsic larynx, treated by irradiation, who remained free from growth for the remaining seven years of her life. Hoarseness, so typical of tumours arising from the cords, was not a feature in her history, but significantly, the patient complained of difficulty in swallowing, a symptom often observed with cancer of the extrinsic laryngeal areas. It is frequently possible to eradicate tumours of the extrinsic larynx by irradiation, usually without the need for tracheotomy; but in our experience to date, the majority of these patients have died of uncontrollable neck metastases within two years.

Carcinoma of Intrinsic Larynx:

Cancers of the intrinsic larynx, unlike those of extrinsic origin, are usually composed of a well differentiated adult type of squamous epithelium. The patient's outlook should be better than average if treatment is undertaken early, provided it is possible to obliterate the local disease. This, however, is uncertain as these growths, relatively insensitive to irradiation and difficult to cure by this means, involve important structures which one hesitates to sacrifice by radical surgical extirpation. Laryngofissure and hemilaryngectomy, with no resultant disability and a functional voice, is a satisfactory alternative for those whose growth is small and limited to the mid or anterior portions of a still freely movable cord. Relatively few individuals, however, are acceptable for this conservative operation and they also represent the type most ideally adapted to treatment by irradiation. Confronted with a patient reasonably curable by hemilaryngectomy, we are apt to offer a choice between operation and irradiation. Unfortunately for most patients with cancer of the intrinsic larynx, no operation less radical than a total removal of the larynx offers hope of cure, and in this group we believe that irradiation is usually the treatment of choice. The management of the case is, however, difficult and requires daily expert clinical supervision. The problems involved and their solution, in some instances, can best be exemplified by the recital of a few case histories.

Case 2. A male, aged 52, was admitted in 1944 with a carcinoma on the anterior two-thirds of the right cord. The tumour involved the ventricle and extended to, but did not cross the anterior commissure; the right cord was fixed. During a period of 81 days he received 11,600 r of heavily filtered 200 kv X-ray therapy through three small ports. The reaction was minimal and the patient is well 9½ years later with some slight scarring of the anterior portion of the now freely movable cord. He has a good voice.

Comment: Fixation of the cord and extension to the ventricle made cure by laryngofissure and hemilaryngectomy uncertain. The alternative procedure was laryngectomy, with its accompanying disabilities and operative hazards of the pre-antibiotic days.

Case 3. A male, aged 53, persistently hoarse for six months, was admitted in June 1939. A greyish exudate covered the anterior two-thirds of the swollen and immobile left vocal cord: biopsy revealed a fully differentiated epidermoid carcinoma. The tumour proved unusually resistant to 200 kv x-radiation and was not considered to be eradicated until he had been given a total skin dose, measured in air, of 18,225 r, administered in fractional doses six days a week over a treatment period of 153 days. Three years later the patient, a diabetic, underwent a Gritti Stokes amputation for gangrene. He steadfastly refused diabetic care, and was re-admitted in coma on November 12, 1945 with a blood sugar of 730 mgms. and died on the following day. There was no recurrence of the laryngeal cancer.

Comment: The history presents an example of an instance of cancer of the intrinsic larynx successfully treated by X-ray therapy

without recurrence to the time of death from intercurrent disease 6½ years later. This patient tolerated irradiation extremely well and was given considerably more treatment than is usually required. Attempts to administer doses of this magnitude have terminated fatally and are no longer permissible.

Case 4. A male patient aged 43 with a cancer involving the anterior half of the right cord, extending across the anterior commissure and into the right ventricle, received in the 74 days between September 23 and December 4, 1944, 4,700 r to each side of the laryngeal area and 2,200 r anteriorly, for a total dose of 11,600 r as measured in air with factors similar to those used on the previous case. On completion of treatment the tumour had disappeared but there was some oedema of the larynx which was subsequently aggravated by a persistent cough. At examination on February 3, 1945 a small area of slough was found in the region of the left cord. On February 12 the patient developed stridorous breathing. Tracheotomy and laryngofissure were performed; on dividing the thyroid cartilage and mucous membrane in the midline, an infected ulcer was found occupying the site of both cords and the ventricles. The right ala of the thyroid cartilage and the soft tissues of both sides were removed well beyond the ulcerative area, as well as the right arytenoid cartilage. On microscopic examination, infection and necrosis of the cartilage were found, but no tumour cells. The patient made an uneventful recovery and remains well with a permanent tracheotomy opening, but has sufficient airway to his pharynx to speak audibly.

Comment: Another fatality was prevented by adequate surgical intervention in the presence of a critical complication. Although the end result in this instance is better, the operation may leave the patient in a condition comparable to that following upon laryngectomy. Laryngofissure, for necrosis following upon irradiation, has been successfully carried out on seven patients. During the last four years, the use of improved radiation techniques and antibiotic therapy have rendered this drastic interference unnecessary.

Case 5. A female aged 57, with a history of hoarseness for one year and recent difficulty in breathing, was admitted on April 26, 1948. The anterior two-thirds of the left cord, the commissure and adjacent portion of the right cord, were oedematous and greyish in colour. Biopsy from the left cord revealed a squamous cell carcinoma grade 2 plus; a section removed at the same time from the anterior end of the right cord showed only chronic inflammation. Laryngofissure was performed on May 17. The right cord, although somewhat scarred, did not appear to be involved in the growth. A rectangular incision was made through the mucous membrane to the level of the cartilage enclosing the entire left cord as far posteriorly as the vocal process of the arytenoid and the mucous membrane, cord and false cord were removed along with the anterior two-thirds of the left wing of the thyroid cartilage, the anterior commissure and the anterior fifth of the right cord. Subsequent pathological examination showed epidermoid carcinoma in both the left and removed anterior portion of the right cords. The wound healed well, and while it was realized that hemilaryngectomy had not been an adequate operation for this patient, the larynx appeared free from cancer until on October 14, 1948 a recurrence was noted in the anterior end of the right cord and confirmed by biopsy. Total laryngectomy was performed on November 8 and the patient's condition remains entirely satisfactory with no evidence of tumour.

Comment: Although we do not hesitate to remove the anterior portion of the opposite cord, we were misled by the erroneous pathological report on tissue taken pre-operatively from the end of the right cord — obviously from a site not well chosen — to attempt cure by a conservative operation which we do not believe should be used if the growth actually does cross the midline. Fortunately, the error was discovered by the finding in the laboratory of cancer at the line of resection through the opposite cord and remedied on the first sign of recurrence by the prompt performance of total laryngectomy.

Results

Eleven of the 43 patients admitted between 1935 and 1948 inclusive lived five or more years. Five of these cases have been reported in detail. The rates used in this paper are *absolute*. There are no untraced patients; those who refused treatment are included, and the ones who died of intercurrent disease or other causes are listed amongst the deaths: there are no exclusions. With these criteria the five-year survival rate is 26 per cent. The survival rate for cancer of the extrinsic larynx is 6 per cent, for the intrinsic larynx 40 per cent. Originally we salvaged 20 per cent of the patients with cancer of the intrinsic larynx, but 45 per cent of the 1942 to 1948 patients survived five years. Inasmuch as no

patient in this series has died of cancer after two and one-half years, it is significant that 75 per cent of those treated for cancer of the intrinsic larynx during 1948 and 1949 are alive.

Summary

The case histories presented illustrate some of the hazards involved in treating cancer of the larynx, the measures that may be taken to avoid dangerous complications, and the steps by which one may extricate the patient from his critical condition should such situations—at times unavoidable, but more often resulting from inadequate or injudicious care — be permitted to develop. The methods finally adopted are those that, in our experience, have been found to be most satisfactory.

Cancer of the extrinsic larynx is treated by fractionated x-radiation. Should metastases occur to the cervical nodes, the anaplastic nature of these tumours does not fulfill the requirements laid down by Quick for block dissection of the neck, but instead, calls for adequate supplementary surgical exposure and radon or radium implantation.

Early cancers of the intrinsic larynx, confined to the mid or anterior portions of a single and movable cord, and not extending anteriorly to the commissure or posteriorly to the arytenoid, may be adequately cared for by laryngofissure and hemilaryngectomy, or just as satisfactorily by efficient roentgen therapy.

More advanced cancers of the intrinsic larynx, if treated by surgery require laryngectomy and can in many instances be more advantageously irradiated. We prefer reserving laryngectomy for the radio-resistant cases or the failures that still occasionally follow upon *good* and more often result from *mediocre* or *bad* radiotherapy. Involvement of the cartilage necessitates surgical intervention.

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INTERNATIONAL CLUB OF RADIOTHERAPISTS

At the Seventh International Congress of Radiology held in Copenhagen, July 1953, radiotherapists were invited to discuss the proposed formation of the "International Club of Radiotherapists". The proposal met with acceptance by the group but there was general concurrence that the organization should be an informal one and in no way compete with or interfere with the general functions of The International Congresses of Radiology.

Membership has been tentatively limited to 100, but may be altered at any subsequent meeting of the International Club. The maximum number of members from any one country at present is 15, and the following radiotherapists represent Canada on the list of proposed foundation members of the Club:

Dr. Clifford L. Ash, Toronto, Ontario
Dr. Jean Bouchard, Montreal, Quebec
Dr. A. Maxwell Evans, Vancouver, British Columbia
Dr. Origene Dufresne, Montreal, Quebec
Dr. Ethlyn Trapp, Vancouver, British Columbia
Dr. T. A. Watson, Saskatoon, Saskatchewan.

The first international meeting of the entire Club will be held at the next Congress of Radiology, which will be held in Mexico City. Until that time the following were asked to serve as a co-ordinating group: General Co-ordinator, Dr. Ralston Paterson; Secretary for the European Section, Dr. Jens Nielsen; Secretary for the American Section, Dr. Simeon T. Cantril.

XXVe ANNIVERSAIRE

Fondée en 1928 par les Drs. L. A. Gagnier, Léo Parizeau, Albert Comtois, R. Mayrand, J. E. Gendreau, Eugène Panneton, Chs. Langlois, R. Potvin, E. P. Grenier, J. E. Perron et H. Lacharité, la Société Canadienne Française d'Electro-Radiologie Médicale vient de célébrer son 25e anniversaire par un banquet, au cours duquel tous les membres présents ont remémoré des souvenirs amusants, historiques ou mémorables.

Les buts qui lui avaient été assignés par ses fondateurs, soient: l'étude des possibilités diagnostiques et thérapeutiques de l'Electro-Radiologie et la propagation des sciences électrologiques et radiologiques dans les milieux médicaux et para-médicaux ont été pleinement atteints. En effet, durant son existence d'un quart de siècle, elle a étudié bien des sujets originaux, scientifiques ou pratiques de radio-diagnostic et de radiothérapie.

Si on parcourt les comptes rendus de ses réunions mensuelles ou trimestrielles, on est favorablement impressionné par le nombre, la variété et la qualité des communications qui y ont été présentées. On peut dire sans hésitation, qu'elle a fait une oeuvre très utile pour ses membres, tout en contribuant au prestige de la Radiologie Canadienne.

Pour faire connaître aux médecins et aux chirurgiens, les services que peut leur rendre la Radiologie, la Société C.F. d'Electro-Radiologie Médicale a fortement incité ses membres à participer aux réunions des Sociétés Médicales et para-médicales ainsi qu'aux nombreux congrès des Médecins et Chirurgiens de toutes spécialités. La liste des communications, des discussions et des travaux qui y ont été faits par les membres de la Société C.F. d'Electro-Radiologie permet d'affirmer que cette dernière a joué un rôle très important dans la diffusion des connaissances électro-radiologiques au sein de la Profession Médicale.

La fondation de la Société, dont on célèbre cette année le 25e anniversaire, fût donc une heureuse réalisation. Aussi doit-on rendre à ceux qui lui ont donné naissance, qui l'ont maintenu vivante ou qui ont contribué à son rayonnement, un témoignage de vive reconnaissance.

Longue vie à la Société C.F. d'Electro-Radiologie et honneur à ses membres fondateurs!

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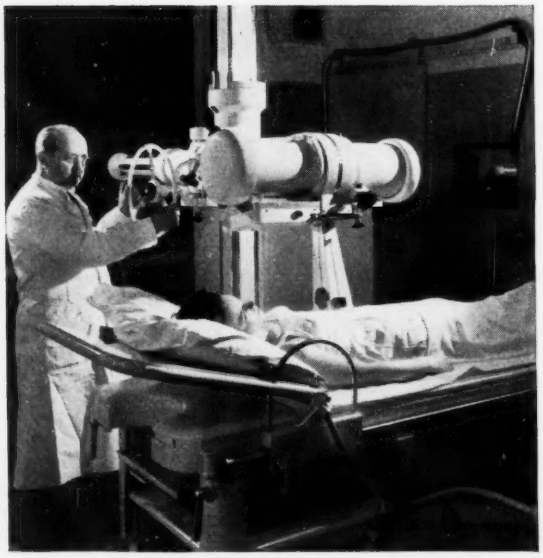

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